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Improving asthma self-management education through inhaler labeling

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ABSTRACT

Objective: Improper use and poor understanding of asthma medications can lead to poorly controlled asthma, emergency department visits, and hospitalizations for children with asthma. Pharmacists play a critical role in improving asthma medication adherence through education on asthma self-management. The use of color-coded labels applied at pharmacies to help patients differentiate between rescue and maintenance inhalers has not been explored.

Methods: Pharmacies were recruited to join a community pharmacy asthma coalition. Pharmacists provided patient education and labeled inhalers with two types of color-coded stickers. A red sticker labeled "RESCUE" was used for short-acting β-2 agonist medication inhalers. A green sticker labeled "USE EVERY DAY" was used for inhaled corticosteroids (ICS) or combination ICS/long-acting β-2 agonist medication inhalers.

Results: During the two years of the pilot program, 25 pharmacy locations participated. Pharmacies labeled over 6000 rescue and 9000 controller medications using color-coded labels. Over 1000 children and 7000 adults were served by the coalition.

Conclusion: Color-coded asthma medication labels can be successfully utilized by pharmacies. This low-cost tool provides vital information regarding the proper use of asthma medications.

Innovation: The color-coded labeling of asthma medications is a novel innovation that can be successfully used by pharmacists to improve asthma self-management education.

1. Introduction

Asthma is a leading chronic disease in pediatric patients, affecting more than 5 million children in the United States [1], at an estimated cost of over $80 billion each year [2]. It is one of the primary causes of hospitalization [3], resulting in missed school days for children and adolescents and missed days at work for caregivers [4,5]. A cornerstone of current asthma management is the use of inhaled asthma medications [6]. Inhaled medications for pediatric asthma are divided into two categories: *quick-relievers*, primarily consisting of short-acting β-2 agonists (SABA) and *controllers*, consisting of inhaled corticosteroids (ICS) with or without concomitant use of long-acting β-2 agonists (LABA) [6].

Health care providers caring for patients with asthma encounter barriers in providing high-quality asthma care, including inadequate patient asthma education and self-management skills. It is well established that low adherence to medications is a main factor contributing to uncontrolled asthma [6-10]. Studies indicate that up to 30–70% of patients prescribed asthma medications have chronic or episodic medication nonadherence [11-14].

To promote adherence to treatment, patients and caregivers must understand the distinct categories of asthma inhaler medications with specific uses in asthma management. Patients may not adhere to asthma therapy as prescribed due to misunderstanding of each medication's purpose [15]. Pharmacies label inhaler boxes with instructions on dosage and clinical usage per prescription, but these boxes are easily discarded and may not be referred to again. Furthermore, once removed

Abbreviations: AAP, asthma action plan; CPAC, community pharmacy asthma coalition; ED, emergency department; ICS, inhaled corticosteroid; LABA, long-acting β-2 agonist; MTM, medication therapy management; NAEPP, National Asthma Education and Prevention Program; NYSCEHC, New York State Children's Environmental Health Centers; PC, pharmaceutical counseling; SABA, short-acting β-2 agonist; SMART, single maintenance and reliever therapy.

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from the manufacturer's packaging, inhaled asthma medications usually only detail drug names, ingredients, and safety information but do not include directions for use.

Gaps in patients' understanding of their asthma medications lead to confusion regarding when a particular medication should be administered [16-19]. Patients and caregivers may erroneously use their rescue inhaler daily or use their controller medication during an acute exacerbation, only for their asthma symptoms to worsen [20-22]. Asthma medication nonadherence leads to poor health outcomes, lowers patients' well-being, and increases healthcare costs [13,14,20,21,23]. Conversely, taking medications as prescribed and participating in asthma self-management education services results in better asthma control [14,23-25].

Asthma self-management education is a fundamental component of asthma management that is recommended in current asthma guidelines [6,10]. Asthma education includes the provision of information about asthma medications and use of inhalers, prevention of symptoms and exacerbations, monitoring and control of asthma, regular medical review, and a written asthma action plan (AAP) [6,10,26-28]. Providing a written AAP has been shown to lead to improved outcomes such as increased patient adherence to ICS and asthma control, reduced emergency department (ED) visits, unscheduled doctor visits, and days missed from work and school due to asthma [26,29,30]. However, only approximately half of children with asthma in the United States have a written AAP [31]. Furthermore, many primary care providers face barriers to providing clinic-based asthma education, such as demands on time and lack of trained support staff to deliver educational services [25,32].

Partnerships with pharmacists may help bridge these asthma care gaps in the primary care setting. Pharmacists can help by promoting medication adherence and providing asthma self-management education to supplement the care received in the primary care setting [28,33-39]. Pharmacists' interventions in asthma management may include pharmaceutical counseling (PC) about drug information, as well as the provision of educational materials and written AAPs [28,40]. Pharmaceutical counseling interventions can improve asthma control, lung function, and medication adherence while reducing use of SABA and biologic medications, as well as decreasing ED visits, hospitalizations, and school absenteeism [14,36,37,39,41].

Asthma inhaler labels are a specific category of PC interventions that have not been well studied. Inhaler technique labels provided by pharmacists have been shown to improve retention of correct inhaler technique skills with dry powder inhalers [42]. These labels for asthma inhalers can also help improve adherence of asthma medications and have been successfully used in the primary care setting [25,43]. The use of color-coded labels for asthma inhalers applied by pharmacists is a novel intervention not described in the literature.

Previous studies have shown that community asthma coalitions can successfully achieve asthma policy and systems changes to improve health outcomes [23,44,45]. The goal of this pilot project was to assess the feasibility of labeling asthma inhaler medications at local and regional pharmacies.

2. Methods

2.1. Participants

In 2018, the Albany Medical Center Children's Environmental Health Center, part of the New York State Children's Environmental Health Centers (NYSCEHC) [46], with the help of a regional managed care organization, Capital District Physicians' Health Plan (CDPHP), formed a community pharmacy asthma coalition (CPAC) consisting of stakeholders from local, regional, and national chain pharmacies in the geographic region along with other community organizations, including the Albany College of Pharmacy and Health Sciences.

The procedures for labeling asthma inhalers were carefully reviewed by the applicable pharmacy review boards of the coalition partners before participating in the labeling efforts. Pharmacies voluntarily participated in the coalition and did not receive any financial incentives other than coalition supplies (e.g., labels, educational materials, and posters), which were supplied free of charge. No business or legal agreements were made between Albany Medical Center and coalition partners. The Albany Medical Center Institutional Review Board approved this pilot project. The CPAC implemented labeling efforts in the region over a two-year period, from 2019 to 2020. Owing to the impact of the COVID-19 pandemic, the coalition disbanded in early 2021.

2.2. Intervention

Participating pharmacies agreed to dispense inhaled asthma medications labeled with two types of color-coded stickers with the goal of improving asthma self-management education. A red sticker, labeled "RESCUE," was used for all SABA medication inhalers. A green sticker, labeled "USE EVERY DAY," was used for all ICS and ICS/LABA medication inhalers designated as controllers. The color and text for each label were chosen using inputs from pharmacists, physicians, and consensus from coalition members during the initial planning meetings in 2018. Pharmacists attempted to affix the label directly to each inhaler medication. If customers preferred an unlabeled inhaler, pharmacies were instructed to attach a color label to the inhaler box. Participating pharmacies developed their own systems for labeling or utilized available guidance from the coalition for suggested, medication-specific labeling. A pharmacy student intern created a guide for labeling various asthma medications for pharmacists which was distributed to the participating pharmacy members (Supplement). The low cost per label was maintained by purchasing labels in bulk quantities from a local packaging supply company. The approximate total cost for all inhaler labels used by pharmacies during this two-year period was $300.

During the initial coalition formation meetings, pharmacies also expressed a desire to deliver written asthma self-management education to patients. Participating pharmacies agreed to provide written AAPs, educational handouts, and display asthma educational posters in the pharmacy. The number of written AAPs provided by pharmacies was used as a second process measure for the pilot.

2.3. Data collection and analysis

A coalition champion from each participating pharmacy served as the primary contact for their organization. Monthly in-person coalition meetings were conducted after several initial planning meetings. The coalition coordinator emailed a survey link to each participating pharmacy quarterly using the Qualtrics survey platform. Each survey included several questions regarding pharmacy asthma self-management education and inhaler labeling process measures, such as the number of written AAPs provided, number of controller and rescue medications labeled, and number of unique patients served by the pharmacy, delineated by age (children, 0–17 years, and adults, 18 years and older). Individual patients were counted once but their medication (s) could be counted multiple times, as the labeling efforts were our primary process measure of interest. Participating pharmacies utilized their own internal methods for tracking these measures; the coalition champion from each pharmacy was responsible for ensuring that reported data was accurate. No further methods of data tracking were utilized as no formal business agreements were made between the project team's institution and coalition members. Each quarterly survey included two qualitative questions designed to elicit feedback from pharmacy customers and staff. The first question was, *"Please describe the patient compliments, suggestions, or success stories in more detail."* The second question was, *"Do the pharmacists or staff at your location have any suggestions to improve this program?"* Owing to coalition pharmacy concerns about reporting safety events outside their respective

Table 1
Summary data.

Year	# Reporting Pharmacies (each quarter)	Controller Inhalers Labeled	Rescue Inhalers Labeled	Written AAPs Provided	Number of Children Served	Number of Adults Served
2019-Q1	14	793	612	1022	149	1017
2019-Q2	14	2505	1788	3102	296	1938
2019-Q3	0	–	–	–	–	–
2019-Q4	1	55	53	–	105	3
2020-Q1	13	2361	1930	3291	245	2009
2020-Q2	14	1232	964	2764	81	851
2020-Q3	5	1177	967	2741	93	762
2020-Q4	5	1094	472	1083	93	1025
Total		**9217**	**6786**	**14 003**	**1062**	**7605**

organizations, no questions about inhaler labeling safety-related events were included in the quarterly survey. All data were exported from Qualtrics and tabulated in Microsoft Excel. Descriptive data analysis was used to determine the success of coalition labeling efforts.

3. Results

At the start of the pilot, 21 regional pharmacies agreed to participate. Four additional pharmacies were added over the two-year pilot program for a total of 25 participating outpatient pharmacies. Approximately 14 000 AAPs were distributed. Pharmacies labeled over 9000 controller medications and over 6000 rescue medications using color-coded stickers (Table 1). Over 1000 individual children and 7000 adults were served by the coalition. There was an increase in both the number of controllers and rescue inhalers labeled in quarters 1 and 2 of 2019. There was a gap in the reported data for quarters 3 and 4 of 2019. Coinciding with the emerging COVID-19 pandemic, coalition labeling efforts showed a decreasing trend throughout 2020.

4. Discussion and conclusion

4.1. Discussion

This pilot project demonstrated the feasibility and challenges of creating and sustaining a pharmacy coalition to improve asthma self-management education and inhaler labeling services for patients. Although primarily intended to target the pediatric population, the participating pharmacies served a greater number of adults with asthma in this geographic region. This information would be informative for those interested in targeting adult patients with asthma. As our survey tool did not delineate the age distribution of these adult patients, we were unable to determine the percentage of younger adult patients (18–21 years) with asthma. The project was also primarily focused on improving select process measures, principally providing asthma self-management education and labeling asthma inhalers, and was not designed to study other outcome measures, such as improved asthma quality of life measures, ED visit rates, and/or hospitalizations for asthma.

Pharmacists can play a key role in providing self-management education for patients with asthma, as demonstrated by the number of written AAPs provided and the number of inhalers labeled during this two-year project. Health care providers should be aware of potential financial incentives for pharmacists that may facilitate collaborative efforts to improve asthma self-management education services in community settings. Similar to the value-based incentives for asthma care in the primary care setting (e.g., asthma medication ratio or AMR), pharmacists may be eligible for managed-care organizational value-based incentives for asthma. Pharmacists may also be interested in promoting services that deliver value to patients. One such example is pharmacist billing for medication therapy management (MTM), a term used to describe a broad range of health care services provided by pharmacists [23,47,48]. Pharmacy MTM services for asthma can be further enhanced through effective collaboration with health care providers.

It is also important to note that the coalition's labels were created in 2018, prior to the 2020 focused update to the National Asthma Education and Prevention Program (NAEPP) Guidelines [49]. This is significant because, in addition to SABA and ICS medications, a newer category of medication, known as single maintenance and reliever therapy (SMART or MART), has been increasingly recognized as a highly effective category of medication for patients with asthma [49]. During the pilot's time, the NAEPP guidelines had not yet recommended SMART and, as such, the coalition did not implement SMART-specific labels.

This project had several limitations that impacted the work of the CPAC. One of the challenges of this two-year project was achieving consistent project coordination. The designated coalition coordinator role was transitioned several times from the initial coordinator at the managed care organization, to the College of Pharmacy, and, finally, to an asthma nurse coordinator at Albany Medical Center. While attempts were made to minimize the impact of changing coalition leadership, this had a negative impact on the consistent collection of data from participating pharmacies.

There were several limitations to the data collection from the coalition. Several coalition participants did not provide data and the extent of labeling efforts at those locations was uncertain. Although considered as coalition members, these pharmacies were not included in our results. Another limitation was inconsistent pharmacy reporting. Despite telephone and email requests from the data collection team, there was a gap in quarter 3 of 2019, where no pharmacies submitted data. There was also an unexplained decrease in quarter 4 of 2019, where very few inhalers were labeled. We were unable to obtain informative feedback from pharmacies as to why this occurred during these quarters. Our Qualtrics survey did not include detailed pharmacy process measures, such as the total number of unique patients or asthma medications filled per quarter to use as a denominator, or whether each pharmacy used the number of dispensed inhalers that were labeled, or the number of stickers used, to quantify the number of inhalers that were labeled. We were unable to verify whether the written AAPs provided by the pharmacies were reviewed by the patients' primary care provider. Another considerable limitation is whether each patient had asthma medications filled at more than one pharmacy, which may have resulted in multiple written AAPs being provided by more than one pharmacy location, or multiple AAPs that contain slightly different instructions.

Our Qualtrics survey also did not include information on whether pharmacies ever provided extra or unaffixed stickers to patients to label at home. This is a potential safety concern as certain asthma inhalers have similar colors (e.g., ProAir® and Symbicort®). However, to our knowledge, this issue did not occur during the time of the coalition's activities, as pharmacies were instructed to affix the label in the store and not send them home with patients to apply.

Finally, and perhaps most importantly, the COVID-19 pandemic began two years into the coalition's work. Healthcare systems in the region saw a significant decrease in asthma exacerbations and overall healthcare utilization [50-52]. Coinciding with the emerging COVID-19 pandemic, there was an overall decrease in labeled asthma medications in 2020. Several possible contributing factors were identified through

personal communication with the partners. First, one regional chain pharmacy scaled its labeling back from 12 to 4 pharmacy locations in quarter 3 of 2020 to focus on the quality of the labeling process. Second, several pharmacy partners reported having stopped placing the stickers on inhaler medications in 2020 because of patient concerns for COVID-19 and complaints of "open and contaminated" medication packages. Third, one independent community pharmacy was closed permanently. Additionally, the coalition partners reported that many patients and their caregivers were not filling their asthma medications out of fear of being exposed to COVID-19 while receiving care at pharmacies. Lastly, during the beginning of the COVID-19 pandemic, many school-age children with asthma experienced pandemic-related changes, such as mandatory mask wearing and remote learning, with associated decreases in asthma exacerbations and need for medications [50,51].

Future endeavors for the coalition may include expanding participation with additional pharmacies in the region, educating pharmacists on the use of SMART therapy, and ensuring that pharmacy-provided written AAPs are reviewed by the primary care provider. In addition, the coalition identified the need to survey caregivers and patients with asthma about their inhaler labeling preferences to inform future efforts.

4.2. Innovation

This pilot demonstrates the feasibility of an innovative approach to improving asthma education and self-management through the provision of color-coded stickers on inhalers distributed at pharmacies. This low-cost intervention may be successfully implemented at community pharmacies to help improve education for patients with asthma.

Additionally, this pilot demonstrates ways in which a community pharmacy asthma coalition can augment asthma management outside of the primary care setting. The establishment of this coalition as a collaborative force for partnering with pharmacies to provide asthma educational interventions demonstrates an innovative approach to the challenge of delivering outpatient asthma education for children and caregivers.

4.3. Conclusion

Pharmacists play a key role in asthma care and management. Community pharmacy asthma coalitions can improve asthma self-management education using written AAPs and color-coded labeling of asthma inhalers. These low-cost tools provide patients and caregivers with vital information regarding the proper use of their inhaled asthma medications. Health care providers can play a key role in building and sustaining coalitions with pharmacies to promote better asthma care. Further studies are warranted to determine the impact of color-coded asthma medication labels on asthma outcomes, including school absenteeism, ED visits, and hospitalization rates.

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CRediT authorship contribution statement

Lea C. Dikranian: Writing – review & editing, Writing – original draft, Project administration, Conceptualization. **D. Elizabeth Irish:** Writing – review & editing, Writing – original draft, Software, Resources. **Kathleen E. Shanley:** Methodology, Investigation. **Don R. Walker:** Methodology, Investigation, Conceptualization. **Stephen K. de Waal Malefyt:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT to improve grammar and readability of select portions of the manuscript which had already been written by the authors. After using this tool/service, the authors, reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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